PROVISION OF PUBLIC TRANSPORT INFORMATION TOWARD SMARTER TRAVEL: CASE STUDY OF KLANG VALLEY AND PENANG, MALAYSIA

Syahriah BACHOK[1], Diana MOHAMAD[2],
Transport Systems Centre[1], School of Natural and Built Environment[1,2]
University South Australia
City East Campus, North Terrace, 5000 Adelaide
Australia
Nor Zalina HARUN
International Islamic University Malaysia
Jalan Gombak 53100 Kuala Lumpur
Malaysia
Syahriah.Bachok@postgrads.unisa.edu.au

ABSTRACT

This paper explores the existing public transport information systems in two case studies. Developing cities like Kuala Lumpur and Georgetown in Malaysia face great challenges in providing effective and efficient public transport information to travellers. By and large, travellers need the information to make smart travel decisions. The information to feed smart decisions can be enhanced by the application of intelligent and integrated public transport information. Smart travel decisions include optimal departure and arrival times, selection of environmentally friendly modes, selection shortest routes and smooth interchanges between different road- and rail-based public transportation. Smart travel decisions have potentials in reducing the outcomes of inefficient travels especially congestion and pollution. Smart travel decisions can also increase public transport ridership such as on road-based feeder buses and track-based light and heavy rail systems.

This paper also focuses on the provision of multimodal information and the extent to which the information can promote better trip making decisions. In particular, pre-trip, way-side or at-terminal and en-route or on-board information will be presented. Two case studies of *Klang Valley* and *Penang* regions will be compared and discussed. It is envisaged that informed decisions will increase planned trips, which would be executed and completed efficiently. These will in turn, improve the overall quality, smoothness and enjoyment of the journeys made. The conclusions drawn will be based on users' personal perspectives of the adequacy and quality of the various information types, especially with regards to assisting them in making smarter travel decisions.

1. INTRODUCTION

Transportation can be defined as the mechanism of moving goods and passengers by any type of vehicles from one point to another. Transportation can be further categorised into public transport and private transport. Within the public transport, there are important systems without which the vehicles cannot operate efficiently. These public transport systems consist of several systems of rolling stocks, routing, maintenance, track and crossing safety and security as well as information system.

Multimodal transportation can therefore be termed as the carriage of goods and passengers from one locality to another, over land, water and air by at least two different modes of transport. The coverage of this definition is too wide for this paper to deal with. Hence, it will only concentrate on the bridging of distances by passengers across two points within the public transport system. The related information system will be explained in relation to the provision and use of the system deliveries by these passengers especially when making trip-related decisions.

This paper further discusses the existing body of knowledge pertinent to information provision. From the review of the prominent literature, three research questions have been raised. Observational surveys have been undertaken to provide some answers to these questions. The surveys involved the researchers' team of "typical" passengers riding and experiencing "typical" multimodal public transport system in the selected case studies. The findings will be discussed against the optimal provision of effective and efficient information that promotes smart travel decisions. Recommendations on the establishment and management of a single public transport authority were on the basis of its non-existence, and the need for an integration of fragmented jurisdiction and power among different agencies handling public transport issues in the case study areas. Conclusions drawn will include the absence of integrated multimodal information leading to impediments to smart travel decision making among the existing and prospective public transport passengers. The next section will discuss the relevant literature on multimodal public transport and information systems.

2. MULTIMODAL PUBLIC TRANSPORTATION

Information provision and its positive outcomes among multimodal public transport users have been studied worldwide. Travel decisions can be made more efficiently. Additionally, more informed choices led to smart travel decisions. The information was provided with the aim to aid passengers in choosing quicker routes and modes to their destinations than they would normally do unassisted. Benefits of information acquisition and utilisation were time savings, reduced variation of travel time and anxiety levels, increased safety conditions and road networks efficiency.

Public transport passengers' requirement of information about their journey can be identified with four stages of trip making. They are categorized as pre-trip to destination stage, at-stop, on-board and pre-trip to origin i.e. return journey (Caufield et al., 2005, Huber, 1996, Higbee, 1991). In addition to four travel choices (i.e. departure time, mode, route, parking availability), passengers may also need information on the traffic conditions, station or stop location, door-to-door connection and possibly the current weather. Next, having arrived at the stop or station, they may seek information on one or more particular trip, including arrival time of the next service, location and direction of platform and other personalised information regarding the station's facilities. If connecting mode is necessary, this information will need to be accessed on-board the public transport vehicle. Finally, upon reaching destinations, passengers may need to repeat the similar process, this time, for their return trip.

The information may be static or dynamic in nature or both. Static information is fixed information, such as fare rates, route and bus numbers, scheduled departure and arrival times, frequency of services, journey durations, stations or terminal locations and directions, feeder services and parking facilities. In contrast, dynamic information is changeable information which can be provided in real time. Examples are weather reports, traffic conditions, incident and accidents detections, alternative routes or modes availability and accessibility, countdown of departure and arrival time for the next service, continuing journey mode accessibility and available parking capacity (Balogh and Smith, 1993, Wright et al., 2004, Holmes and Lane, 1993). Most of these information types can be found in the more developed public transport systems of advanced countries. While the advantages of information provision have been widely studied in these public transport systems, little is known about such benefits in typical developing countries' public transport systems.

Real time information is one of the most valued information among users. It is increasingly displayed as variable message signs along major roadsides. Typically, three types of information are disseminated. They are control information (e.g. speed limit), weather and environmental information (e.g. snow hazards) and informative or trip planning information (e.g. road network conditions) (de Saint-Laurent et al., 1993, Variable Message Signs, 2000, Wisconsin Department of Transportation, 2000). Some of these information types were hardly provided in many public transport systems in developing cities. As such, the impacts of information provision towards smart travel decisions have yet to be fully explored.

Public transport information system in developing cities can be measured using several methods, two of which its effectiveness in inducing demand for public transport trips and its attractiveness to retain the existing level of patronage. While quantifying the benefits have been widely carried out by many researchers, there were also significant body of knowledge focusing on the qualitative assessment of information provision. This study adopted the latter approach to evaluate of public transport information systems. Other research has also proposed that the perception of users regarding the information supplied have greatly influenced the effectiveness of any information provided. Hence, the proposed research attempts at examining these perceptions, with specific reference to users' requirements for multimodal public transport journeys in developing cities.

The reviews of relevant literature provided insight into the contemporary travel decision making process. The reviews have also identified some of the latest or more advanced provision of information, in both forms of media of dissemination as well as the sophisticated information contents.

Based on the review of literature, three research questions have been identified. First is: what is the current state of multimodal information system in a typical developing city? Second is: how useful would the information be in planning, executing and completing a multimodal public transport trip? In other words, it raised the question of adequacy and quality of information provision. Finally, how can the information system be improved so as to induce more smart travel decisions?

3. METHODOLOGY

Literature review has also explored suitable and appropriate methodologies for this type of research. While many others have their own positive outcomes and drawbacks, observational survey has been selected for this study due to three factors. First, observational survey has an advantage of capturing the data or information through an actual experience of a trip maker. Second, data or information collection throughout the different stages of the journey can be captured by a single traveller, thus reducing the biasness of generalisation of perception. Third, observational surveys are more cost effective and time saving than household or intercept surveys and mail-back or telephone/internet/computer aided surveys.

The study adopts observational surveys by three different public transport users in two case studies. These surveys were divided into two, one for each research question. The first type of surveys dealt with the inventory of existing information provision. The second surveys focused on the use of the information in trip planning and making.

The analyses involved comparing and contrasting the experiences of three different users, one being a "typical" student, another being a "typical commuter" and a third being "an elderly with a physical impairment". These users were given checklist of what constitute important information for smart travel decisions. They would identify and describe these items throughout their journey using public transport. The information was categorised into those provided pre-trip, at-terminal, en-route and for connecting trips. These were further sub-divided into static or dynamic types and whether they were available in one or more of the three forms namely audio, text and graphic or visual. Users were also requested to orally record their likes and dislikes regarding their travel and interchanges experiences. All input were gathered and transcribed as qualitative data.

Two qualitative measures of optimal multimodal public transport information were adopted. One the hand, effective is defined as the deliverance of outcomes that fulfil the need and requirements of the end users. This definition, however, does not cover accuracy, reliability and confidence. On the other hand, efficiency reflects the capability of providing such information with the least cost incurred. The 'travellers" were asked to examine these two qualities of public transport information. They would adopt their own perception as to how effective and efficient can the information assist them in making smart travel decisions. Smart travel decisions in this study referred to selecting the least cost modes, the quickest routes,

the shortest travel time and the most comfortable, smooth and convenient trip making and completing experiences.

Data was collected under hot, equatorial daytime conditions, using a piece of checklist paper and voice recorder. The checklist provided a number of items that a passenger of multimodal public transport system would require when planning and executing any journey. The checklist, while not exhaustive, also contained the optimal information need for passengers trip involving at least one transfer from buses to either taxi, ferry or rail services. These optimal levels of information were based on many examples in developed cities including Tokyo, Singapore, London and Tokyo. The types of transport evaluated covered buses, rails, ferries and taxis. The overall services and specific information provision would be investigated so as to identify and improve the problem areas within the systems.

4. RESULTS OF THE FIELD STUDIES

Based on the results obtained from the observational surveys of information system, it was decided that an investigation into the effectiveness of the provision should be undertaken. The analysis was categorised into two tasks. Firstly, major literature review and site observation would quantify the existing and optimal information provision for multimodal public transport journeys. Second, observational survey of "typical" public transport journeys would provide qualitative outcomes of the information provision's effectiveness towards assisting users to make smarter travel decisions. Most of these outcomes have been transcribed from the recorded audio files. The remainder of the findings have been related orally by the "trip makers" or "travellers" to the researchers and recorded manually.

The tests of public transport rides were analysed so as to answer the research question of how useful would the information be in planning, executing and completing a multimodal public transport trip) and how much can be done to improve the existing systems to suit a "typical' traveller's need. Two case studies were selected for these purposes.

Penang or *Pulau Pinang* is one of the 13 states in Malaysia. The study area covers only the island, an area of 293km^2. The state has a population more than 1.4 million (2005) with about 46 percent residing on the island side. The relatively high population density, car ownership and car use were almost comparable to those of *Klang Valley* (approximately 400 vehicles i.e. including motorcycles per 1000 population). There was a great pressure on road demand. Even though there was an established bus and ferry systems, the current modal split was not in favour of public transport.

The public transport system is mainly bus-based. The bus services are inconsistent, running a relatively low frequency. The information at the bus and ferry termini was perceived as inefficient and ineffective. Taxis were only in areas of lowly covered bus services, the airport and major shopping centres.

The low bus patronage is attributable to the high car use and this led to congestion which has in turn has exacerbated the traffic jam in the city during peak hours. *Penang* has earlier overhauled or restructured the bus systems in April 2006. The system was privately owned and operated bus systems. They applied the licenses and determined their own routes and schedules. Social routes are neglected, some bus operators have leased out their buses which was not allowed under the conditions of licensing. They have also disregarded the terms of services which included issues of tickets to all passenger and improving the conditions of the buses as set by a vehicle inspection authority appointed by the government. The previous systems have been unreliable and unable to service the public. The system was deemed to fail and they have caused great inconveniences to the public. After three months, people were still not satisfied because the systems have gone from bad to worse.

In the early 2009, the number of bus service providers has been reduced to only 4. There are *Transit Link Sdn. Bhd*., *Milan Travel Sdn. Bhd*, *KGN Hin Bus Co. Sdn. Bhd* and *Rapid Penang Sdn. Bhd.* There was a sudden halt to a service by one of the previous bus company the *Yellow Bus Company Sdn. Bhd*. that led to the creation and establishment of *Rapid Penang*. It has also been planned that *Rapid Penang* to provide the major services in the city while the

remaining three services would support or feed the main bus system. Currently, *Rapid Penang*, which is a government-owned company that belongs to *National Infrastructure Company Limited*, is serving eight main travel corridors. It uses colour-coded approach for easy recognition of its 38 routes of 150 bus services and fare structure.

It was found that fares were structure according to distances. At an interval of seven kilometres, a fare would increase gradually by 50 cents, with those on concession ticket receiving a discounted 50 percent fare. It was also found that the schedule was not fixed at an interval or particular headway but rather given as a range of intervals.

An almost similar story can be depicted in the second case study, *Klang Valley* region of Malaysia. It is the most prosperous region in the country, consisting of an area of 243km^2 called Federal Territory and a surrounding conurbation of 5,400km^2. The region is densely populated by some 5 million residents (2007). Vehicle ownership stood at 500 per 1000 population. Modal split was currently at 85:15 favouring private vehicles. Only one percent of the total trips were made by rail-based transport.

In *Klang Valley*, the recent restructuring of public transport systems can be traced to as early as 1994. In that year, *Intrakota* buses joined the Cityliner buses to take over all bus operations in the Klang Valley. At the end of 1996, the first light rail transit system STAR-LRT began its operation. Having roamed the city for more than a decade, the minibus system ceased to exist in 1998. The routes were soon covered by Intrakota buses to complete the major overhauled of bus system in the region. By end of the same year, the second LRT system PUTRA-LRT began operating. There were many issues with the operation and management of both light rail systems including interests debt and loan repayments. As a result, a government owned company was established namely *Syarikat Prasarana Negara Bhd*. took over the ownership and operations of PUTRA-LRT and STAR-PUTRA. The restructuring scheme was targeted to integrate fare structure, physical and rolling stocks, network systems and marketing. While many initiatives and actions were concentrated on the public transport systems as a whole, the information systems were however neglected. In September 2003, the Monorail system was in place to complete the inner city rail services. By this time, the government company also took over the assets of Intrakota and Cityliner in a move to consolidate and integrate most of the public transport services in *Klang Valley*. A year later, the government announced a formation of *Rangkaian Pengangkutan Integrasi Deras* (Rapid Integrated Transportation Network) or RapidKL to take over public transport operations from *Syarikat Prasarana Negara Bhd*. The first RapidKL buses hit the road in November 2004. One of the main aims this time around was to upgrade, integrate and optimally utilise the bus and rail systems in terms of fleets, information and resources.

The information system consisted of timetable, route and accompanying map usually provided in both in paper and internet form. Departure and arrival time are published only by one rail operators namely *KTM Komuter*. Other rail services only provided headways or services frequency or intervals. All services provided information on the departure time of the first and last services for the day. Announcement of arrival at the next stations were made on all services.

Information has been provided in both static and dynamic manners. Static information can be found in the forms of leaflets, posted signage and direction, folded papers and fliers. They can be read, though some are illegible from a certain distance. They can also be easily visualised, even though some users would find it slightly challenging to orientate themselves when provided by north-directed maps. Dynamic forms of information were delivered as prompted public announcement, VMS, and pictorial presentation of situational changes to services.

Fare structures provided clearly at ticket counters, stations and on the website. Interchanges terminal or stations and transfer facilities are indicated on the route maps. However, they can be misleading. Sometimes interchanging requires one to check out of and in the station because the tickets are not integrated. In most cases, transfers would require users to travel by walking by great distances, sometimes under the heat of the sun since stations are not physically integrated in their truest senses.

With the introduction of trunk buses that feed the train stations, passengers were provided by high accessibility to rail stations from residential areas. However, very little information can be gathered from the bus services regarding such connections. For example, neither departure nor arrival time was indicated in the bus or by bus drivers. Moreover, neither indication of which platform the next services will depart from nor any information regarding next or connecting buses arrival time was provided. Buses were scheduled at an interval of 20 minutes. However, passengers would normally complain of the schedule in-adherence by the drivers. Passengers have been reported to complain of 40 minutes interval and sometimes of one hour headways. Direction, locality and transfers information within a single station or terminal was also poor. However, in major terminal or interchanges such as *KLSentral*, *Bandar Tasek Selatan*, *Putra*, *Bank Negara* and *Chan Sow Lin* are fairly effective. So were terminal such as *Seremban*, *Pelabuhan Klang*, *Sentul* and *Rawang*.

In *Penang*, transfers from the ferry terminal to taxis and buses, were deemed smooth by “trip makers” albeit the imperfect information scenarios. Figures 1 and 2 show the interchanges between ferries and buses and taxis. All modes were within walking distances and transfers were facilitated by posted maps of routes, services schedules and location of waiting facilities. However, there was a need to check-out from and check-in to the connecting modes’ station because fares were not integrated. There was no protection against the natural elements.

Figure 1: Interchange between buses and ferries

Figure 2: Exiting the ferry terminal towards the bus main terminal

From the observational inventory of the information system, the researchers found out that issues regarding public transport services are interrelated, especially those relating to integration. Integration in its truest sense should encompass physical or rolling stock and route network integration, fare integration, terminal or interchanges integration, scheduling of fleet and information integration. Based on the findings of the “travellers”, it seemed that both systems in *Penang* and *Klang Valley* did not possess these qualities.

Some problems that can be identified with public transport in the region have been highlighted in many South-east Asian transport studies. These included the non-existence of a single

authority holistically handling the public transportation issues, operation and management. Three reasons for this scenario are the obstruction of physical elements such as routing, fleet sizes and technologies, land and financial matters.

Some problems encountered by the users included the ineffective and inefficient deliveries of public transport systems. First, buses do not have published schedules. Timetables are largely provided in a form that only indicated the headways rather than departure or arrival times at important bus stops or trip sections. Second, routes have been restructured so that buses function according to hierarchy, such as *UTAMA* (trunk), *BANDAR* (city) and *TEMPATAN* (local). Previously one can travel from his or residential area riding only one bus to the city. However, with the new structure, one has to hop on and off to transfer between different buses to get to the city. Fares have also been restructured. An increase in fares was inevitable. However, the problem area was the need to purchase different tickets for different bus types. There exist three types of tickets. All day LOCAL bus ticket at RM1 is valid for local journeys to rail stations, all-day TRUNK buses at RM2 is required for trip into the city from the residential district in the region while all-day CITY bus ticket at RM2 is valid only for inner city travel which connects major shopping or commercial districts. There used to be an integrated day ticket costing RM7 which covered all buses and rail systems (RapidKL networks only). However, this ticket has ceased from issuance due to economic reasons.

Another problem faced by the researchers' team of "travellers" was comprehending the information and utilising it for smart travel decision making process. Smart travel decisions are defined in a very loose context in this research. It covers the ability to decide on travel mode, trip departure, arrival and overall travel time. Smart travel decisions also deal with estimating the connecting trip's travel time, the direction and location of interchanging points or platforms, the ability to complete the journey smoothly and in the optimally convenience manner as the "traveller" has aspired.

The selection of mode would not be difficult because most were captive users. The information on fare structures and the route network have greatly assisted the "travellers". The selection of departure time was based only on static information sought at home, workplace or origin point. The anticipation of the next vehicle arrival time was not provided. The average travel time and arrival at interchange points were also lacking. The information regarding connecting vehicles was almost non-existence and so was the anticipated time lag for transfers between two modes. The location and direction to the vehicles embarking for the continuing trip were provided in static manner prior to embarking on a journey, but there was none provided on-board public transport vehicles.

Figure 3: A dynamic variable message signs counting down of the next vehicle arrival time.

The estimated arrival time at the destination was not supplied on-board vehicles. However, at *KLSentral* station, there used to be a VMS board displaying the estimated arrival time of buses for the first initial period of services. It was no longer functioning during the "traveller's" visit. There was no information regarding delays or disturbance to transport systems en-route or on-board vehicles. But information has been provided on the internet regarding major repair works as well as on alternatives to current mode in the event of delays. Places of interests at final destination were posted on maps at many rail stations. However, information on the return or forward journeys could only be obtained by words of mouth or from counters.

Table 1 shows the list of public transport information items that were being investigated. The checklist provides some guidance to the users as to what is optimally expected out of a "typically" effective and efficient system.

Table 1: An example of a completed checklist of public transport information provision.

Case Study /	**Penang**		**Klang Valley**	
Public Transport Information List	**Bus**	**Ferry**	**Bus**	**Rail**
1. Pre Trip (Static)				
Route map	☑	☑	☑	☑
Route distance	☑	☑	☑	☑
Schedule	☑	☑	☑	☑
Estimated travel time	☑	☑	☑	☑
Fare	☑	☑	☑	☑
Origin direction/location	☑	☑	☑	☑
Interchanges direction/location	☑	☑	☑	☑
(Dynamic)				
Estimated travel time	☐	☐	☐	☐
Countdown of next arrival	☐	☐	☑	☑
Delay	☐	☐	☐	☑
Connection direction/location	☐	☐	☐	☐
Connection countdown of arrival	☐	☐	☐	☐
2. At-terminal (Static)				
Route map	☑	☑	☑	☑
Route distance	☑	☑	☑	☑
Route time	☑	☑	☑	☑
Estimated travel time	☑	☑	☑	☑
Fare	☑	☑	☑	☑
Origin direction/location	☑	☑	☑	☑
Interchanges direction/location	☑	☑	☑	☑
(Dynamic)				
Estimated travel time	☐	☐	☐	☐
Countdown of next arrival	☐	☐	☑	☑
Delay	☐	☐	☐	☑
Connection direction/location	☐	☐	☐	☐
Connection countdown of arrival	☐	☐	☐	☐
3. En-route/In-vehicle (Static)				
Route map	☑	☑	☑	☑
Route distance	☐	☐	☐	☑
Estimated travel time	☐	☐	☐	☐
Fare	☐	☐	☐	☐
Destination direction/location	☑	☑	☑	☑
Interchanges direction/location	☐	☐	☐	☐
(Dynamic)				
Estimated arrival time	☐	☐	☐	☐
Countdown of next arrival	☐	☐	☐	☐
Delay	☐	☐	☐	☐
En-route location/station name	☑	☑	☑	☑
Connection direction/location	☐	☐	☐	☐
Connection countdown of arrival	☐	☐	☐	☐
Places of interest direction/location	☐	☐	☐	☐

One reason for the fragmented and inadequate system was the absence of a single authority overseeing all issues and jurisdictions within the public transport industry. There were 13 agencies responsible for different transportation aspects such as the operation, management, route networks, rolling stocks, information, fares and regulation of public transportation. As a result, integration of the public transport systems especially those involving transfers could not be realised at this point of time. As such, it is proposed that the single authority be established sooner rather than later.

5. CONCLUSIONS

Two case studies of *Klang Valley* and *Penang* have been evaluated with regard to information provision facilitating smart travel decisions. The case studies faced many establishment challenges to achieve a state of sophisticated information provision partly due to the absence of a single transportation authority. While, smart travel decisions can be induced by providing such information, the catchment was limited to existing public transport users. It would not be widely acquired and utilised by private vehicle users due to its imperfection and low accessibility and quality. The information systems assessed, however, have partially assisted the typical “travellers” in he observational surveys to transfer between road-based feeder buses and track-based light and heavy rail systems; much is left to be desired.

This paper has concentrated on the examination of the effectiveness and efficiency of multimodal information. It can be concluded that pre-trip, way-side or at-terminal and en-route or on-board information presented as checklists, were to a certain degree, found useful by the travellers. However, these “travellers” did not find that informed decisions could be made leading to smart travel decision where planned trips could be executed and completed efficiently. Based on these users’ personal perspectives various information types improvements can be targeted at those items found absence in the checklist. As such, public transport operators and service providers can begin with bridging this gap of information deliveries so as to enhance the attractiveness of these collective vehicles. In particular, dissemination of information regarding transfers, delays and dynamic estimated travel, departure and arrival time can be immediately initiated. This would lead to a better environment because travel decisions can be made in an informed situations and less dependence on private vehicles will reduce inefficient congestion and pollution.

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Author: Syahriah Bachok[1] and Diana Mohamad[2]
[1]Transport Systems Centre, University of South Australia, Adelaide, Australia.
[2]School of Natural and Built Environment, University of South Australia, Adelaide, Australia.

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ABSTRACT

This paper deals with the existing public transport information systems in two case studies. Developing cities like Kuala Lumpur and Georgetown in Malaysia face great challenges in providing effective and efficient public transport information to travellers. Smart travel decisions including departure time, mode and route selections and smooth interchanges between different road- and rail-based public transportation can be enhanced through intelligent and integrated public transport information. Smart travel decisions have potentials in reducing outcomes of inefficient travels especially congestion and pollution, as well as increasing public transport ridership including road-based feeder buses and rail-based light and heavy rail systems.

The paper hence, focuses on the provision of and the extent to which multimodal information can promote better trip making decisions among users. In particular, pre-trip, wayside or at-terminal and en-route or on-board vehicle information provision in the two case studies will be presented, compared and discussed. Informed decisions increased the prospective of a trip being planned, executed and completed smoothly and possibly improved the overall quality and enjoyment of the journeys made. The conclusions drawn will be based on users' perspective of the usefulness of the various types of information in assisting them making smarter travel decisions.

Keywords: travel decisions, trip making, public transport, information.